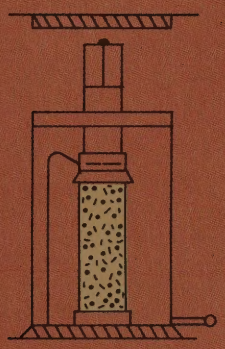
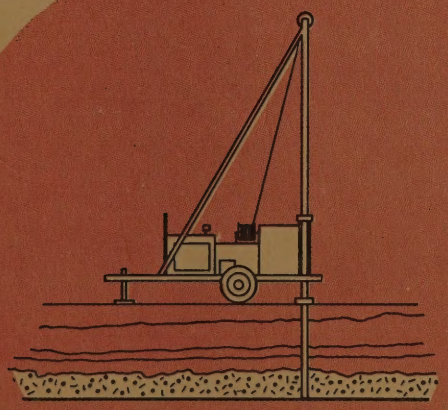
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS
BUREAU





ROCK SLOPE STABILIZATION

TSP 67-1
TACONIC STATE PARKWAY
(KITCHAWAN ROAD-BALDWIN ROAD)
WESTCHESTER COUNTY

PIN 8107.00 301

SM 238a (1/69)

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE June 8, 1971

SUBJECT TSP 67-1, TACONIC STATE PARKWAY, KITCHAWAN RD. TO BALDWIN RD. WESTCHESTER COUNTY, PIN 8107.00-301, RECOMMENDATIONS FOR REMEDIAL TREATMENT OF ROCK SLOPES

FROM Wm. P. Hofmann, Soil Mechanics Bureau, Rm. 102, Bldg. 7
By: Wesley P. Moody Wesley P. Moody

TO M. N. Sinacori, Region 8

cc: J. Sternbach, Construction Sub., Rm. 401, Bldg. 5

Attached please find three copies of a memorandum prepared by Mr. Clayton L. Bolton, Assistant Engineering Geologist of this Bureau concerning a field inspection of this project which also includes recommendations for remedial treatment of rock slopes.

We concur with the recommendations contained in Mr. Bolton's memorandum.

WPM:RSG:jar

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MEMORANDUM
DEPARTMENT OF TRANSPORTATION

DATE June 7, 1971

SUBJECT TSP 67-1
TACONIC STATE PARKWAY (KITCHAWAN RD. - BALDWIN RD.)
WESTCHESTER COUNTY, P.I.N. 8107.00-301

FROM Clayton L. Bolton, Assistant Engineering Geologist CB

TO Wesley P. Moody, Associate Soils Engineer

On May 20, 1971, representatives of Blauvelt Engineering Company, Region No. 8 and this Bureau met on the subject project. The meeting was requested by Mr. P. Pizzo, Project E.I.C. for the purpose of reviewing the rock cuts along the "NE" Ramp and the Northbound Lanes south of the Croton Reservoir Bridge. The review was made to ascertain the types and location of remedial treatment necessary to obtain minimum maintenance, hazard free rock slopes. The recommendations are as follows:

Scaling

1. Light scaling is necessary at the following locations:

   a) Northbound between Stations N373+00± and N437+50± and for the "NE" Ramp between Stations 6+50± and 13+45±.

      This includes removal of all small fragments on the rock slopes plus larger pieces of stone which have been loosened by blasting. These larger pieces were pointed out and their locations noted by Mr. R. Fiorentino of Blauvelt Engineering Company at the time of the inspection.

   b) The east slope of the Southbound, Stations S367+50± to S369+00±, right (see Figure No. 1).

      The area should be re-scaled and all loose stone removed. Due to the blocky nature of the rock excessive heavy scaling should be avoided to prevent a condition similar to that which has already occurred on the Northbound. (See Section 2c and Figure No. 3)

2. Heavy scaling is necessary at the following locations:

   a) "NE" Ramp Station 8+90±, right.

Remove loose rock from V-shaped notch at the top of the slope.

b) "NE" Ramp Stations 10+70± thru 11+15±, right (see Figure No. 2).

A large mass of rock rests on a natural joint plane which dips toward the Northbound Lanes at an inclination of one vertical on one horizontal. Between "NE" Ramp Stations 10+70± and 10+90±, right, holes should be drilled on a one on one slope along a line formed by the intersection of the joint plane and the existing ground surface behind the mass. Beginning at "NE" Ramp Station 10+90±, right, the drilling angle should gradually be steepened to meet the two vertical on one horizontal slope at "NE" Ramp Station 11+15±, right.

c) The "nose" of rock between the Northbound and Southbound Lanes at Stations N373+00± and N374+00, left (see Figure No. 3).

Blasting in this area caused excessive breakage of the rock in the lower portion of the slope and as a result undermined the upper slope. The Contractor attempted to remove the overhanging rock by scaling. Due to the blocky nature of the rock, additional unstable rock became exposed on the upper slope as the scaling progressed. It is recommended that all loose stone be removed from the area with care taken to avoid removal of any rock which is keyed into the toe.

d) Northbound Station N414+00±, right (see Figure No. 4).

This area will require heavy scaling to remove the large blocks of rock which lie on a joint plane dipping steeply toward the Northbound Lanes. On April 30, 1969, Mr. J. Howe of the Bureau of Soil Mechanics made the recommendation that this rock should be re-drilled and shot prior to the construction of the east abutment of Bridge No. 6. This is documented in the Project Diary. The Contractor was informed of this recommendation but chose to ignore it.

The heavy scaling recommended for this area would have been unnecessary had Mr. Howe's recommendation been followed.

e) Northbound Stations N377+00± through N379+00±, left (see Figure No. 7).

This rock slope consists of badly weathered rock of a blocky nature which falls within the limits of the widening area (see Page 4, Paragraph 2). Continued exposure of this rock will result in the formation of a talus pile at the toe of the slope. This slope should be thoroughly scaled to minimize maintenance costs.

Rock Bolting

It was concluded that 46 linear feet of rock bolts (6 bolts, six feet in length and 1 bolt, ten feet in length) would be required to stabilize the rock slopes examined on May 20, 1971. The locations of 4 of the bolts are illustrated in Figures No. 5 and 6.

Due to the position of the sun at the time of the examination, photographs of the remaining bolt locations were not obtainable. The locations of the remaining bolts are as follows:

1. One six foot bolt is required to retain a block of rock, approximately three feet wide and five feet high which is located midway up the slope at Station N433+65± on the left. The bolt should be placed near the center of the block on the exposed joint surface.

2. Two six foot bolts are required to retain a block of rock approximately fifteen feet wide and twelve feet high, located midway up the slope at Station N436+40± on the left. Five drill butts are located on the block. The first bolt should be placed midway between the first and second drill butts from the left, approximately three feet up from the base of the block. The second bolt should be located midway between the third and fourth drill butts from the left, on the flat surface approximately three feet up from the base of the block.

> Installation of the rock bolts shall in all cases be normal to the joint plane surface underlying the rock to be bolted.

A major portion of the remedial treatment recommended by this report is within the limits of the area which was widened for the purpose of obtaining additional embankment material. This change was agreed to at a meeting attended by representatives of Region No. 8, the East Hudson Parkway Authority, and the Contractor, Mt. Vernon Contracting Corp. The decision to waive the presplitting requirement in the area to be widened and the slope problems which ensued, were discussed in Mr. V. Bryant's report dated January 21, 1971. The examination of this area was progressed in the standard manner and the treatment recommended for stabilization is that which would normally be applied to obtain a minimum maintenance hazard free rock slope.

The extensive amount of remedial treatment required to stabilize the rock slopes on this project infers that rock of poor quality was encountered and/or the drilling and shooting was poorly controlled. It is true that there is some badly jointed, blocky and weathered rock on the contract, however, proper drilling and shooting methods would have greatly reduced the problems. Mr. V. Bryant's report of January 21, 1971, made note of the fact that under similar rock conditions, areas where presplitting was and was not required showed no appreciable difference in results. He stated, "It appeared that the same procedures were followed whether presplitting was required or not." He further stated that, "Evidence points to the fact that since the Contractor was permitted to deviate from the specification in some areas, operations in other areas where presplitting was required were less than satisfactory." These statements are illustrated in Figure Nos. 8 through 12. At locations shown in Figure Nos. 8 and 9, the presplitting requirement had been waived. At locations shown in Figure Nos. 10 and 11, however, the presplitting requirement was in effect. Figure No. 12 is taken at Station equality N378+00± = "NE" Ramp Station 13+14±, right. This photograph was taken in the transitional region between areas where presplitting was and was not required. In the left third of the photograph, presplitting was required. In the right third of the photograph, the slope is more uniform

even though it was not presplit according to specifications. In this case, the Contractor inadvertently maintained better control of the drilling and as a result produced a more uniform rock slope.

CLB:MVM

Figure No. 1 Stations S367+50± to S369+00±, right.

(Note fallen rock on shoulder)

Figure No. 2 "NE" Ramp Stations 10+55± to 11+25±, right.
Rock should be presplit on a one on one slope starting at Station NE 10+70± (arrow at right of photograph) to NE 10+90± (dashed vertical line, center of photograph). Drilling angle shall be gradually steepened to a two vertical on one horizontal slope at Station NE 11+15± (solid vertical line, left of photograph).

Figure No. 3 - Northbound Stations N373+00± to N374+00±, left.

Figure No. 4 - Northbound Station N414+00±, right.

Photo
No. 5

PHOTO NO 6

Rock Bolts

Figure No. 5 - "NE" Ramp Station 9+65±, right.

Rock Bolts

Figure No. 6 - Northbound Station N378+00±, left.

Figure No. 7 - Northbound Station N378+00±, left.

Figure No. 8 - "NE" Ramp Station 7+00±, right.

Figure No. 9 - "NE" Ramp Station 9+50±, right.

Figure No. 10 - Northbound Station N428+50±, left.

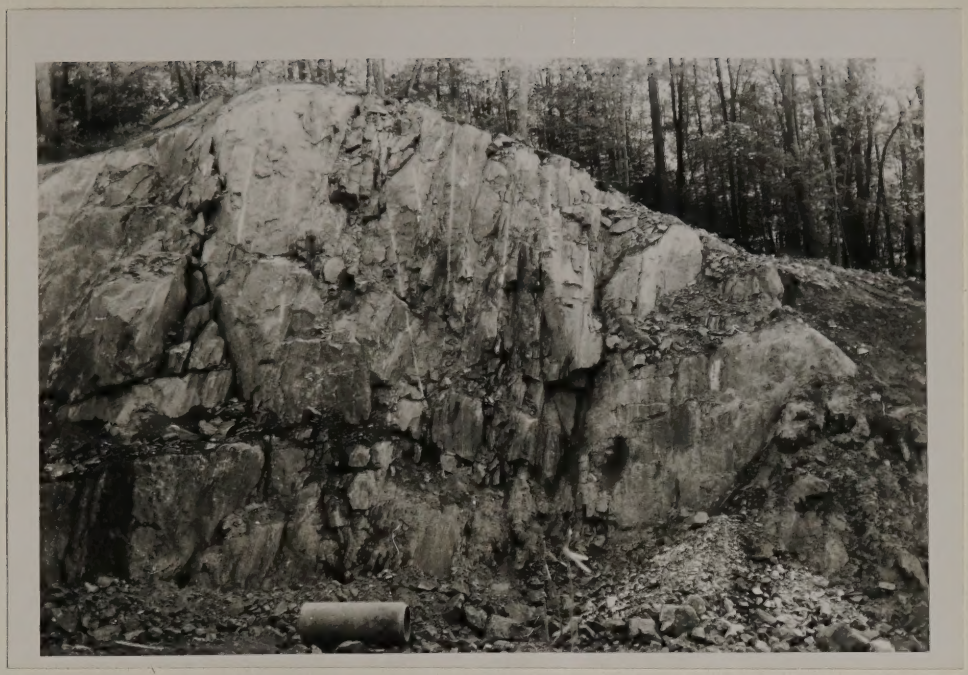

Figure No. 11 - Northbound Station N429+50±, left.

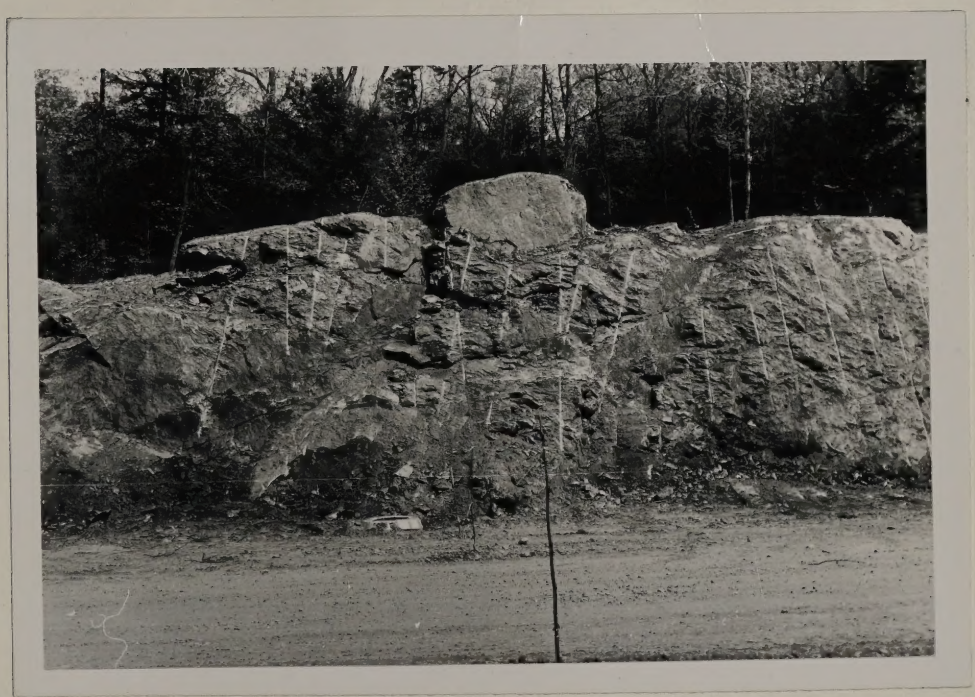

Figure No. 12 - Northbound Station N378+00±, right. Note that the inadvertently well aligned drill holes on the right side of the photograph produced a uniform plane of rupture. Poorly aligned holes in the center and left side of the photograph produced a ragged and uneven slope.

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